(NANO)MATERIALS IN MICROEXTRACTION TECHNIQUES FOR THE DETERMINATION OF COSMETIC-RELATED COMPOUNDS

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INTRODUCTION

The use of **(nano)materials as extraction phase** in microextraction techniques is especially relevant today. Their easy surface modification, which allows to synthesize a great diversity of sorbents and thus to increase their selectivity, and their high surface area make them interesting alternatives to conventional extraction phases.

Combination of different materials, both nanometric and micrometric materials, gives rise to hybrid nanomaterials that maintains the properties of both original materials.

(Nano)materials

- High surface area
- Easy surface modification
- Great diversity
- Selectivity

- (Magnetic) nanoparticles
- Carbonaceous materials
- Metal-organic frameworks
- Polymers

→ Hybrid nanomaterials or composites

OBJECTIVE

This poster briefly overviews the background of our research group in the trace determination of **cosmetic-related compounds** in different scenarios [1], by using different magnetic (nano)materials in the **stir bar sorptive dispersive microextraction (SBSDME)** technique [2].

Cosmetic products

Human body

Environment

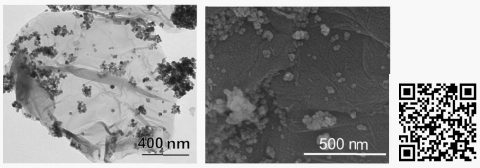
CONTRIBUTIONS

Determination of cosmetic-related compounds in **cosmetics**

Polycyclic aromatic hydrocarbons (PAHs) are hazardous for human health due to their carcinogenic effects and endocrine disrupting properties. They can be present in raw materials (such as paraffinum liquidum) typically used in cosmetic products

Graphene-based magnetic composite

$CoFe_2O_4$-rGO

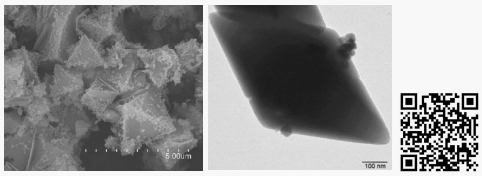


Vállez-Gomis et al., J. Chromatogr. A 1624 (2020) 461229

Nitrosamines are banned compounds in cosmetic products due to their carcinogenic activity. They are unintentionally formed by reaction of specific allowed ingredients in the cosmetic formulation (i.e., an amine and a nitrosating agent)

MOF-based magnetic composite

$CoFe_2O_4$-MIL-101(Fe)

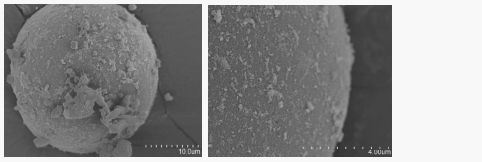


Miralles et al., J. Chromatogr. A 1604 (2019) 460465

Tetrahydrocannabinol (THC) can be present in cosmetic products at trace levels coming from the raw materials of hemp-based products or by isomerization of cannabidiol. As a psychoactive compound, its presence in consumer products should be avoided

Polymer-based magnetic composite

$CoFe_2O_4$-Strata™-X-RP



Azorín et al., Under review

Fragrances are compounds included in many cosmetics to aromatize the product. Some of these fragrances are considered allergens. Recently, some allergens, such as lilial and Lyral®, have been banned in cosmetic products

Polymer-based magnetic composite

$CoFe_2O_4$@p(DVB-co-NVP)

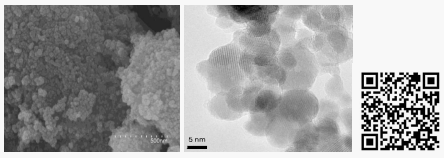
Vállez-Gomis et al., In progress

Determination of cosmetic-related compounds in **environment**

UV filters are compounds commonly present in many cosmetic products to protect us from solar radiation. However, they can reach the environment (waters, sediments, etc) by direct and indirect sources, thus being accumulated there. They are considered as emergent contaminants

Surfactant-based magnetic nanoparticles

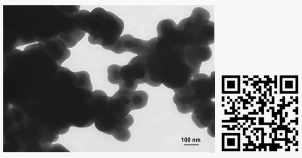
$CoFe_2O_4$@oleic acid



Benedé et al., J. Chromatogr. A 1362 (2014) 25-33
Benedé et al., Talanta 147 (2016) 246-252
Benedé et al., J. Chromatogr. A 1564 (2018) 25

Polymer-based magnetic composite

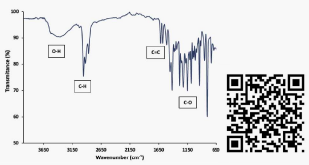
$CoFe_2O_4$@SiO_2-nylon



Benedé et al., Anal. Chim. Acta 926 (2016) 63-71

DES-based magnetic ferrofluid

$CoFe_2O_4$@OA-menthol:thymol

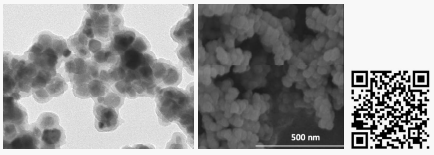


Duque et al., Talanta 243 (2022) 123378

Musks compounds are fragrance chemicals included in many consumer products. Nitromusks are the most restricted family of synthetic musks due to health risks and they are considered as persistent pollutants in the environment

Polymer-based magnetic composite

$CoFe_2O_4$@polydopamine



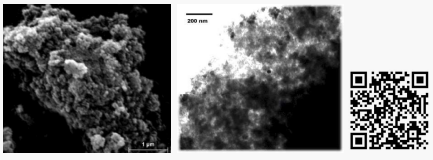
Grau et al., Talanta 231 (2021) 122375

Determination of cosmetic-related compounds in **urine**

Tripenyl phosphate (TPP) is a cosmetic ingredient used as plasticizer in nail polishes. It is partially transformed into its metabolites, mainly diphenyl phosphate (DPP). They are considered endocrine disruptors

Polymer-based magnetic nanoparticles

$CoFe_2O_4$-Strata-X™-AW



Grau et al., J. Chromatogr. A 1593 (2019) 9

CONCLUSIONS

- Different analytical methods to control the presence of prohibited compounds in cosmetic products, as well as cosmetic ingredients and/or their metabolites in biological and environmental samples are necessary to ensure the safety of consumers
- (Nano)materials as extraction phase provides relevant features, especially versatility and selectivity
- SBSDME shows a great versatility to extract different compounds in matrices of different nature

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ONLINE VERSION

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Review

Use of Nanomaterial-Based (Micro)Extraction Techniques for the Determination of Cosmetic-Related Compounds

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Abstract: The high consumer demand for cosmetic products has caused the authorities and the industry to require rigorous analytical controls to assure their safety and efficacy. Thus, the determination of prohibited compounds that could be present at trace level due to unintended causes is increasingly important. Furthermore, some cosmetic ingredients can be percutaneously absorbed, further metabolized and eventually excreted or bioaccumulated. Either the parent compound and/or their metabolites can cause adverse health effects even at trace level. Moreover, due to the increasing use of cosmetics, some of their ingredients have reached the environment, where they are accumulated causing harmful effects in the flora and fauna at trace levels. To this regard, the development of sensitive analytical methods to determine these cosmetic-related compounds either for cosmetic control, for percutaneous absorption studies or for environmental surveillance monitoring is of high interest. In this sense, (micro)extraction techniques based on nanomaterials as extraction phase have attracted attention during the last years, since they allow to reach the desired selectivity. The aim of this review is to provide a compilation of those nanomaterial-based (micro)extraction techniques for the determination of cosmetic-related compounds in cosmetic, biological and/or environmental samples spanning from the first attempt in 2010 to the present.

Keywords: cosmetic-related compounds; microextraction techniques; nanomaterials; sample preparation

Ver Publicación

Desde aquí puede acceder a los trabajos recogidos en esta comunicación:

- V. Vállez-Gomis, J. Grau, J.L. Benedé, A. Chisvert, A. Salvador. Reduced graphene oxide-based magnetic composite for trace determination of polycyclic aromatic hydrocarbons in cosmetics by stir bar sorptive dispersive microextraction. **Journal of Chromatography A** 1624 (2020) 461229.

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Consulta las comunicaciones presentadas por el GICAPC en la **XXIII Reunión de la Sociedad Española de Química Analítica**:

Trace determination of tetrahydrocannabinol (THC) in cosmetic products by stir bar sorptive dispersive microextraction followed by liquid chromatography-tandem mass spectrometry
C. Azorín, J. L. Benedé, A. Chisvert, A. Salvador
Ver Comunicación

Nanomaterials in microextraction techniques for the determination of cosmetic-related compounds
J. L. Benedé, J. Grau, V. Vállez-Gomis, C. Azorín, G. Peris-Pastor, A. Chisvert, A. Salvador
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Low toxicity deep eutectic solvent-based ferrofluid as a green approach for the determination of UV filters in environmental waters by stir bar dispersive liquid microextraction
J. Grau, A. Duque, J. L. Benedé, R. M. Alonso, M. A. Campanero, A. Chisvert
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